

RDRAM Technology

Myths and Realities

The explosive demands from the Internet plus high-performance consumer products are driving the need for more bandwidth. As processor technology has crossed the 1 GHz boundary, the bottleneck in system design has frequently shifted to how fast data can be transferred between chips. Direct Rambus DRAM (RDRAM) technology offers higher memory bus throughput speeds to address the needs for bandwidth. Here are some things you may or may not know about Intel and Rambus technology.

Myth: RDRAM is expensive and will always be more expensive than SDRAM or DDR.

Reality: RDRAM prices are rapidly falling. From Q2 '00 to Q2 '01, the price for a 128 MB RIMM (non-ECC) has come down over 65%. As volumes ramp, 4i technology is introduced, and memory densities continue to increase, RDRAM costs will continue to decline. In 2002, market projections are that RDRAM costs to memory manufacturers will be within 5% of PC133.

"We think RDRAM will be very price-competitive with DDR memory," he said. "If the volumes are high enough, then it may be the same price, and if RDRAM volumes are significantly higher, then it could be even cheaper." – Geoff Hughes, Samsung senior vice president of sales and marketing, San Jose, CA, *EETimes*, 3/29/2001

Myth: RDRAM has limited performance benefits in many applications.

Reality: Dual-channel RDRAM provides 3.2 GB/second of memory bandwidth to the system. Combined with the Intel® Pentium® 4 processor's 300% increase in system bus bandwidth compared to the Intel® Pentium® III processor, today's RDRAM platforms provide noticeable performance benefits. On applications that do not tax system capabilities, such as word processing, RDRAM may indeed provide a limited performance advantage relative to other memory technologies. However, on intense applications that tax system bandwidth, such as XML-based Internet tools, media encoding/decoding, streaming technologies and 3D graphics, the Pentium 4 processor with RDRAM provides a much better user experience. Furthermore, as processor speeds increase, the advantage of RDRAM over alternative high volume technologies continues to widen.

Myth: Memory vendors are not building RDRAM.

Reality: Memory vendors are not only building RDRAM, but they are ramping production at a tremendous rate. Recent press articles:

"Samsung Semiconductor Inc., San Jose, Calif., Monday said it has exceeded \$1 billion in revenue to date from its Direct Rambus DRAM shipments. The Korean chipmaker reiterated that it is expanding RDRAM production to achieve 10 million units a month during this half and 20 million units a month during the second half of the year. The company also repeated its previous announcement that a new, less costly, four-memory bank RDRAM chip will enter production in the second half. The new chip is expected to be 20% cheaper to make than the current 32-bank RDRAM." – *EBN*, 3/19/2001

"Japanese chip and PC maker Toshiba Corp said on Friday it will more than triple its output of Rambus DRAM chips by September while cutting commodity DRAM production, and NEC Corp said it is eyeing a similar move. A Toshiba spokesman said the company would boost its output of Direct Rambus DRAMs, which use technology from Rambus Inc that



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speeds up memory chip performance, to eight million units per month by September from the current 2.3 million units, based on a 128 MB equivalent." – *Yahoo Finance*, 2/9/2001

Myth: *There are no clear benefits to the PC industry of using RDRAM.*

Reality: Two channels of RDRAM deliver high bandwidth with fewer pins than a single channel of DDR. Fewer pins typically lower the costs of discrete chips and motherboards. In addition, lower pin-count technologies enable more fully featured motherboards for a given board size.

Myth: *RDRAM systems are inherently more expensive to build than DDR systems.*

Reality: Initial RDRAM systems were indeed more expensive to build than established SDRAM platforms. However, as RDRAM volumes continue to increase, supporting component and motherboard costs decrease. In fact, Intel believes that in 2002, the cost of a dual-memory channel RDRAM motherboard BOM will be about at parity with a single channel DDR design. The high pin efficiency of RDRAM enables a trend of reduced, not increased, costs with time. The ability to support full memory bandwidth RDRAM on a single memory device enables the industry to move to smaller form factors and less expensive systems using RDRAM in next generation platforms.

Myth: *RDRAM will not be available for upgrades in 2-3 years.*

Reality: Intel plans to continue to drive RDRAM platforms in the future, which will continue to create demand-pull for more RDRAM output. RDRAM is a major part of Intel's long-term roadmap. Additional future RDRAM platforms are committed, staffed and funded.

Myth: *Intel has a contract that obligates them to promote RDRAM.*

Reality: Intel uses and promotes RDRAM because we believe it provides the best performance for our customers, as well as architectural advantages for the PC industry. Intel does license intellectual property from Rambus Corporation, but is under no legal obligation to sell RDRAM technology.

Myth: *Intel collects royalties on RDRAM.*

Reality: Intel does not collect royalties on RDRAM memory technology.

Myth: *Intel has rights to be single supplier of RDRAM compatible memory controllers.*

Reality: Rambus Corporation makes RDRAM memory controller specifications available to any memory controller supplier in order to produce RDRAM-compatible chipsets. As RDRAM chipsets enter mainstream PC systems, it is expected that other chipset vendors will offer RDRAM-compatible chipsets.

Myth: *If Rambus Corporation loses its pending court cases, RDRAM production will cease.*

Reality: Regardless of the outcome of the various legal actions, demand and investment in RDRAM will go forward in the future. RDRAM memory is designed into many high-volume consumer electronic devices today, such as game consoles, HDTV, and digital set-top boxes, in addition to PCs. This creates demand-pull. Memory manufacturers have also invested billions of dollars in equipment to build RDRAM, ensuring that supply capability is in place for the future.

